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Estimation of Coho Salmon Escapement in Streams Adjacent to Perryville, Alaska Peninsula National Wildlife Refuge, 2004

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Jeffry L. Anderson

Abstract

Recent runs of coho salmon *Oncorhynchus kisutch* in the Kametolook, Three Star, and Long Beach rivers near Perryville have declined, and residents can no longer meet their subsistence needs in those rivers. Local residents are now taking coho salmon from streams outside the immediate vicinity of Perryville. With fishing effort spread out to other streams, we need to ensure escapement is maintained to meet the subsistence needs of the Native Village of Perryville. In order to prevent over harvest of these small stocks, escapement in those other streams needs to be monitored. In 2004, two aerial surveys were conducted to count adult coho salmon in streams near Perryville using low-level helicopter flights. During the survey in early October, coho salmon were abundant in most streams near Perryville, while few fish were counted during the survey in early November. Weather and local water quality conditions affected the survey interval and effectiveness in some streams. Numbers of coho salmon counted in 2004 were similar to those observed during surveys in 2003. Surveys in future years will be scheduled earlier than in 2003 and 2004.

Introduction

The residents of Perryville depend on fish and wildlife resources for subsistence, and salmon (primarily coho salmon *Oncorhynchus kisutch*) accounts for more than half of the subsistence food they consume (Hutchinson-Scarborough and Fall 1993). The average harvest of coho salmon in the Perryville area from 1993 to 2000 was estimated to be over 1,900 fish, with a range from 993 (1995) to 3,501 (1994) (ADFG 2002). Recent runs of coho salmon in the Kametolook, Three Star, and Long Beach rivers have declined, with escapement estimated at about 200 fish in 1996 (ADFG 1997a). Several reasons for the decline of coho salmon stocks in the Kametolook River drainage have been suggested, including a decrease in carrying capacity resulting from changes in habitat, over fishing in the river, and over fishing in the ocean. Concerns over poor returns and the inability of local residents to meet their subsistence needs in those three systems motivated the Native Village of Perryville to pass an ordinance that prohibits subsistence harvest in the Kametolook River. In addition, the Alaska Department of Fish and Game (ADFG) engaged in a project in 1996 to rebuild coho salmon stocks in the Kametolook River drainage using incubation boxes, with the intent of improving adult returns by increasing survival from the green egg to swim-up fry stage (ADFG 1997a).

During recent Board of Fisheries and Perryville Subsistence Working Group meetings, local residents stated that they were now taking coho salmon from other streams outside the immediate vicinity of Perryville. In many ways, these streams are similar to streams near Perryville in that they are short, high gradient streams with limited coho salmon abundance. As long as harvest effort is spread among several small streams and harvest effort is not concentrated on one system, the subsistence needs of the village should be met until rebuilding efforts on the Kametolook River become effective.

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With fishing effort spread out to other streams, we need to ensure these runs are maintained to meet the subsistence needs of the Native Village of Perryville. In order to prevent over harvest of these small stocks, escapement in those other streams needs to be monitored. The ADFG monitors pink and chum escapement until early September as part of their normal operation, but discontinue aerial surveys prior to the peak of coho salmon runs (Pappas et al. 2003). This escapement information is needed for effective in-season and post-season management of these stocks. This project was initiated to address these coho salmon monitoring needs. Aerial surveys were used to monitor coho salmon escapement in streams near Perryville. Anderson (2004a) presents results from the first year of monitoring, and this report summarizes the second year of surveys.

Study Area

The Perryville aerial survey area is located on the Pacific Ocean side of the Alaska Peninsula, and is entirely within the boundaries of the Alaska Peninsula National Wildlife Refuge (Figure 1). Coho, chinook *O. tshawytscha*, pink *O. gorbuscha*, chum *O. keta*, and sockeye *O. nerka* salmon, Dolly Varden *Salvelinus malma*, and steelhead *O. mykiss* are present in area streams. Streams were selected for monitoring based on consultations with local residents, documented presence of coho salmon from previous surveys (Pappas et al. 2001), and documented use by Perryville residents for subsistence harvest (Hutchinson-Scarbrough and Fall 1999). Streams chosen for coho salmon surveys included (ADFG stream numbers in parentheses; ADFG 1997b): Smoky Hollow Creek (275-40-10200), Wasco's Creek (275-40-10400), Ivanof River (275-40-10600), Red Bluff Creek (273-70-10200), Ivan River (273-72-10200), and an unnamed river in Humpback Bay (275-50-10200; Figure 1). Clark River (271-10-10310-2021) was also included in the survey since it was the site of a nearby monitoring project for which stream walks had proven to be unfeasible (Anderson 2004b). In 2004, Artemie's Creek (no ADFG number), Three Star River (no ADFG number), Spring Creek (no ADFG number), Cross Creek Slough (no ADFG number), and portions of the Kametolook River (275-60-10100) were included in the surveys (Figure 2). Prior monitoring in these streams had been accomplished using walking surveys in 2002 and 2003 (Anderson and Hetrick 2004).

Methods

Aerial surveys were conducted using low-level helicopter flights. During counts, the pilot maintained the slowest airspeed possible at an altitude ranging from 15 to 50 m above the streambed, depending on the terrain and presence of trees and cliffs. When necessary, the aircraft hovered over large schools of fish and schools with mixed species to assist with the counting. Complete circuits of the study areas were completed either moving upstream from the mouth or moving downstream from the headwaters. Direction of the surveys (upstream or downstream) was dictated by local wind and visibility conditions. Surveys were conducted between 10:00 and 15:00 hours to increase the likelihood of direct overhead sunlight, and polarized sunglasses were worn to reduce glare. Starting and stopping points for each stream survey reach were marked on topographic maps. During each aerial survey, total numbers of coho salmon and other species observed were recorded for each reach. Lighting conditions (sun, partial overcast, overcast), water clarity (excellent, good, poor), and wind-generated surface turbulence (calm, moderate, rough) were qualitatively estimated for each reach. Locations of large areas of coho salmon spawning activity, and large congregations of migrating or staging coho salmon were noted, as were locations and numbers of active fishermen.

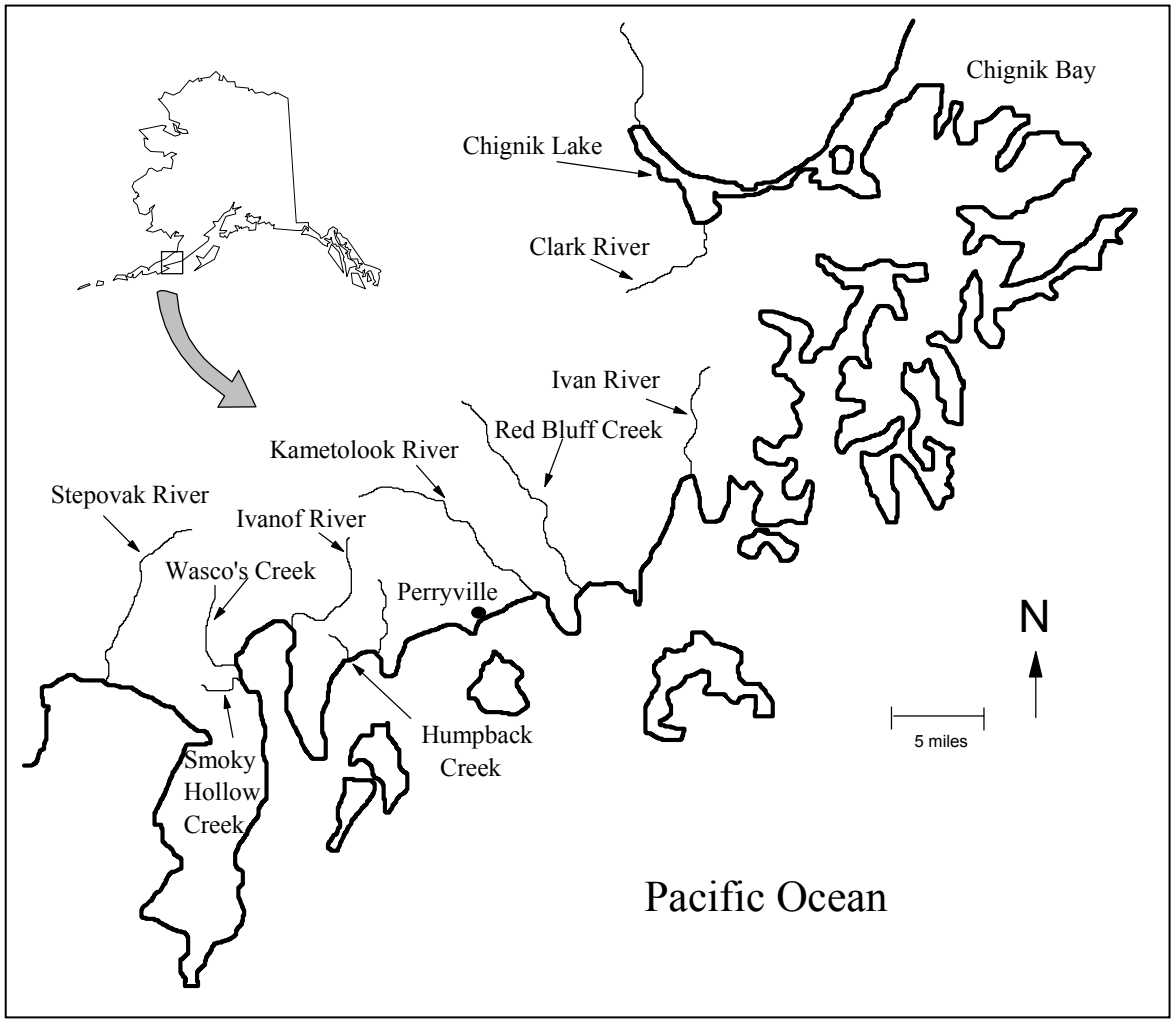

Figure 1. Location of streams in the Perryville area, Alaska Peninsula National Wildlife Refuge.

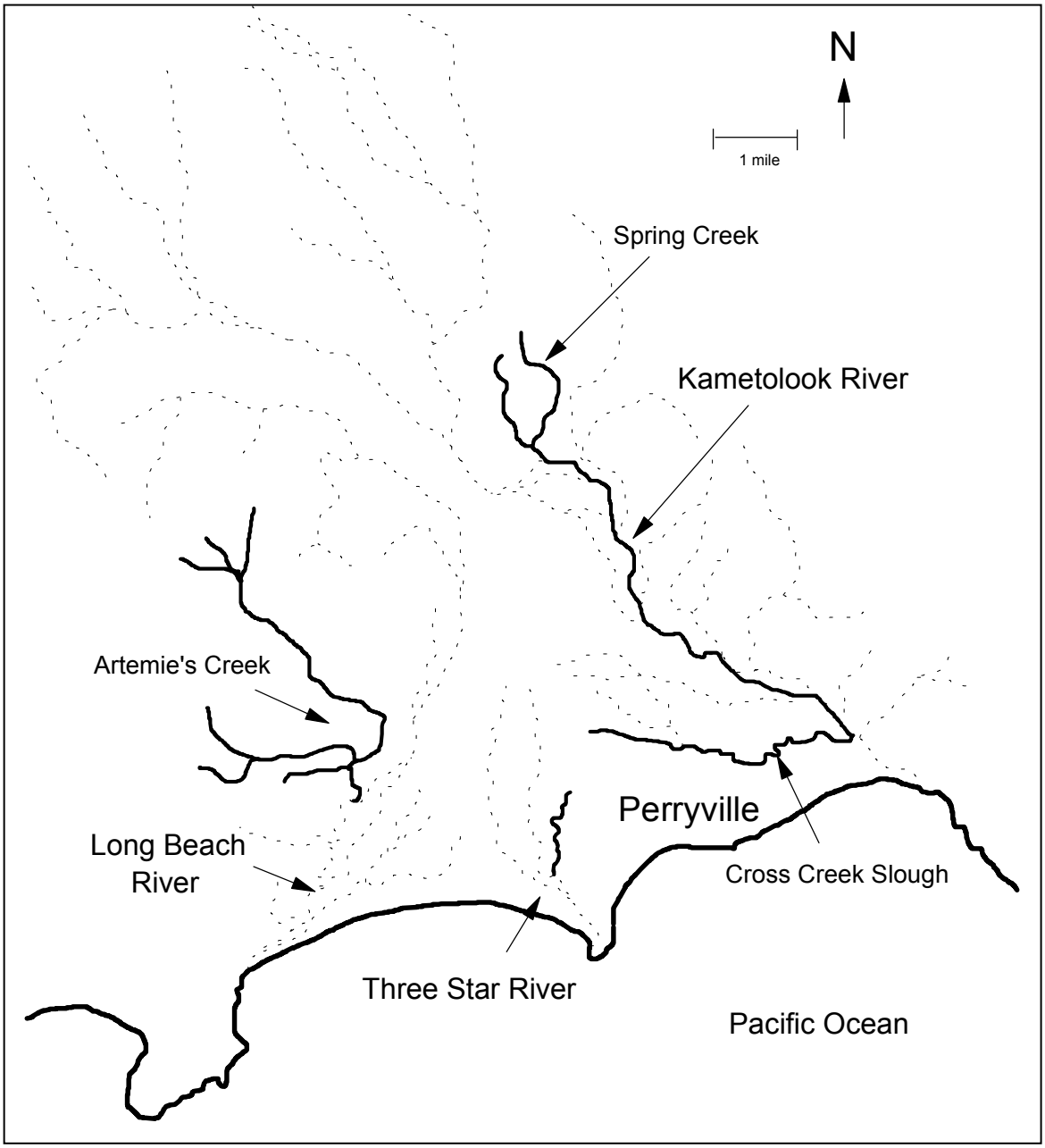

Figure 2. Perryville survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

Two stream surveys were planned, one in early October and one in late October, and were scheduled based on weather forecasts, local stream conditions, and pilot availability. Flights were coordinated to minimize sampling error by avoiding periods of turbid flow and inclement weather. The first survey was completed during 6 and 7 October, and the second survey was completed during 5 and 6 November 2004. Due to logistic constraints (fuel range and available funding), entire watersheds were not surveyed. Generally, mainstem rivers and major tributary streams were surveyed until they began branching into numerous small tributaries, or until the vegetation canopy limited the ability of observers to count fish. Where practical, the stream reach delineations developed during the 2003 surveys were used in 2004. Survey reaches are considered to be index areas, and counts are considered minimum estimates of coho salmon abundance. Our assumption is that periodic aerial counts will provide a minimum index of coho salmon escapement.

Results

The largest numbers of coho salmon were observed during the aerial survey in early October 2004; few were observed during the early November survey (Table 1). More coho salmon were observed in Red Bluff Creek than in other systems, and more sockeye salmon were observed in the Clark River than in other systems. It was not possible to differentiate pink salmon and Dolly Varden from the air, so counts for these species were combined and classified as "Other". Most coho salmon observed in October were staged in large pods and not actively spawning, while most salmon observed in November were paired-up and actively spawning. With few exceptions, surveys were conducted when lighting, water clarity, and surface turbulence allowed for good visibility of fish in the streams.

Two main branches of the Ivanof River were surveyed in 2004 until the canopy limited our ability to see the stream (Figure 3). Smoky Hollow Creek and the unnamed river in Humpback Bay (Figure 3) were surveyed until stream size progressively decreased, and the main stream split into two small tributaries. Artemie's Creek and Cross Creek Slough (Figure 2) were surveyed until impassable waterfalls were encountered. The only branch of the Three Star River that was not captured by turbid water from the Long Beach River was surveyed until the canopy limited our ability to see the stream, and the entire Spring Creek system was surveyed (Figure 2). The Kametolook River was surveyed from the mouth of Cross Creek Slough to its confluence with the Spring Creek system (Figure 2). The mainstem of Red Bluff Creek and its major tributary (Figure 4) were surveyed until the canopy enclosed the streams. The mainstem Ivan River (Figure 5) was surveyed until it became a series of braided, intermittent channels. The mainstem Clark River (Figure 6) was surveyed until it branched into two smaller tributary streams. Coho salmon may have been present in smaller tributary streams that were not surveyed. However, due to logistical constraints (fuel range), these smaller streams were not surveyed. As entire drainages were not surveyed and count intervals were not adequate for expansion to area-under-the-curve estimates, surveys should be considered index counts of coho salmon abundance for a given stream reach and survey period, and not estimates of total abundance.

Table 1. Numbers of fish observed during aerial surveys for coho salmon in streams near Perryville, 2004. CO = coho salmon, SE = sockeye salmon, and Other includes pink salmon, chum salmon, and Dolly Varden.

Stream	October Survey			November Survey		
	CO	SE	Other	CO	SE	Other
Wasco's Creek	[a]	[a]	[a]	[a]	[a]	[a]
Smoky Hollow Creek	300[a]	[a]	[a]	140	0	0
Ivanof River	1,300	3	80	330	0	180
Unnamed River, Humpback Bay	1,040	0	304	46	0	124
Artemie's Creek[b]	52	0	0	18	0	0
Three Star River[c]	8	0	0	3	0	0
Spring Creek	4	10	5	25	0	0
Cross Creek Slough	18	4	2	27	0	0
Kametolook River	[a]	[a]	[a]	44	0	0
Red Bluff Creek[d]	7,600	15	22	836	0	0
Ivan River	1,840	4	0	290	0	0
Clark River	400	5,890	0	800	3,240	0

[a] Survey not completed due to poor water clarity.
[b] Lower reach was captured by glacial water from Long Beach River and was not surveyed.
[c] Mainstem and western fork were captured by glacial water from Long Beach River. Survey numbers represent count from eastern fork only.
[d] East Fork Red Bluff Creek water clarity was poor in lower reaches. Survey numbers represent a minimum count in the East Fork.

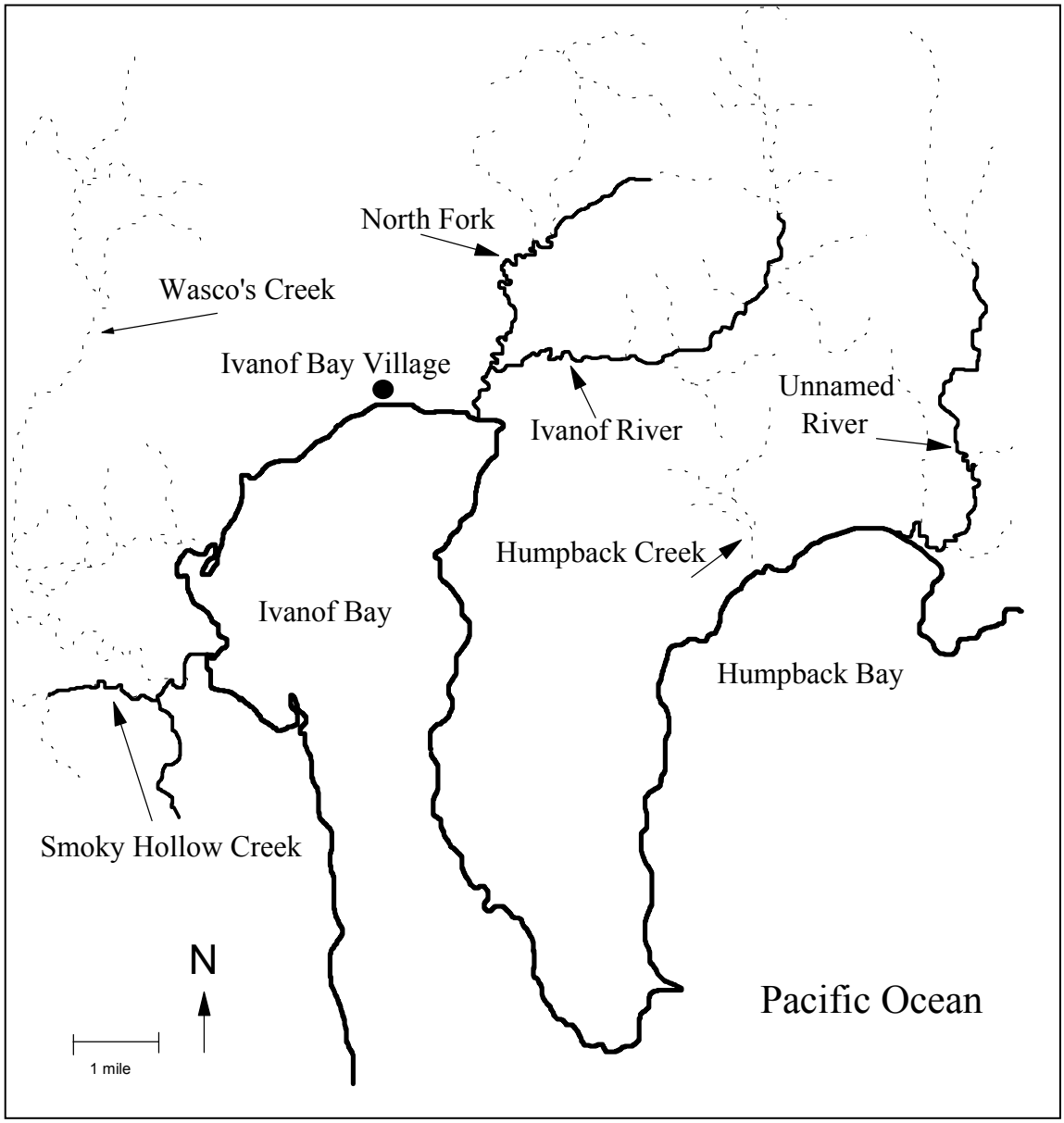

Figure 3. Ivanof and Humpback Bay survey areas, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

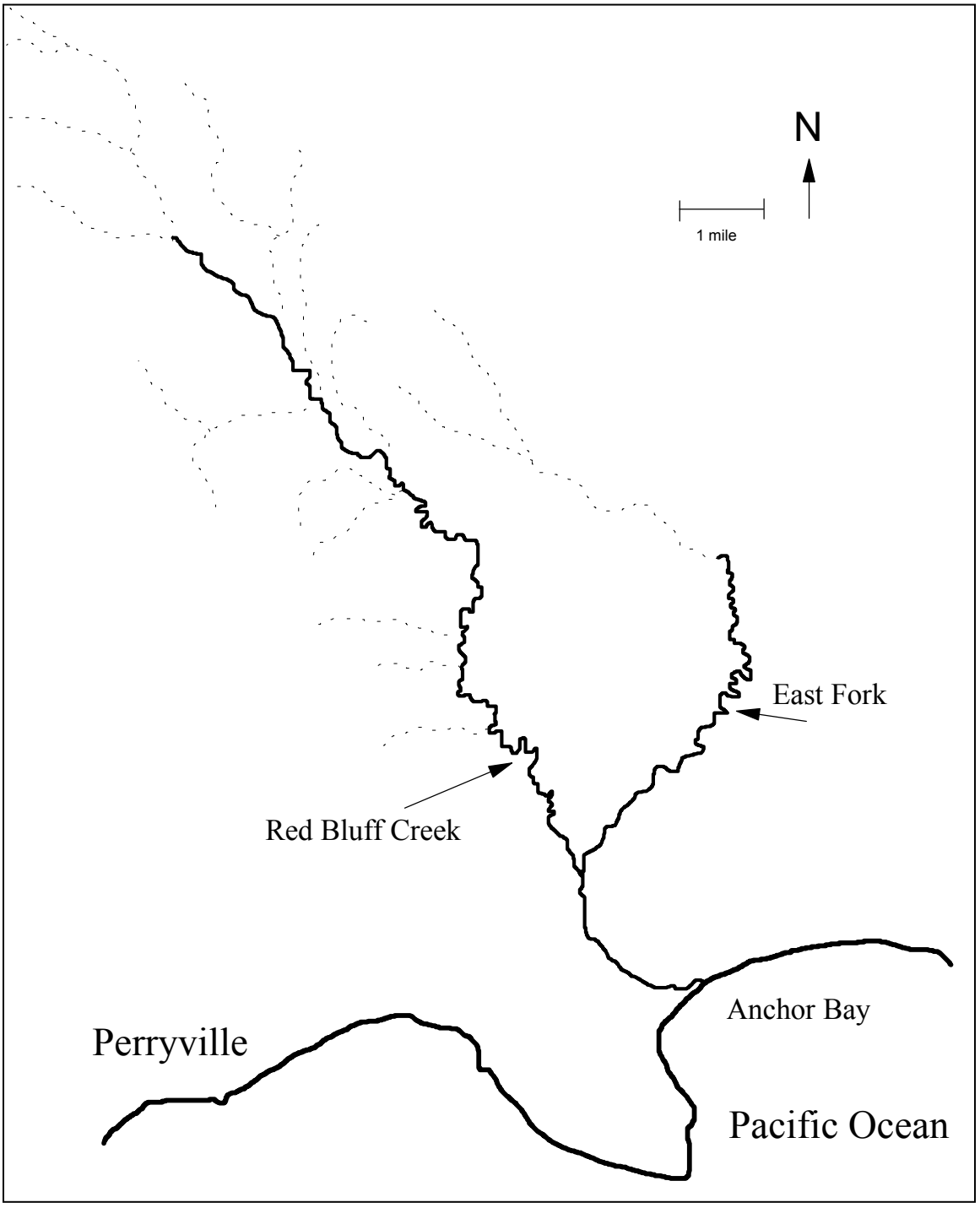

Figure 4. Red Bluff Creek survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

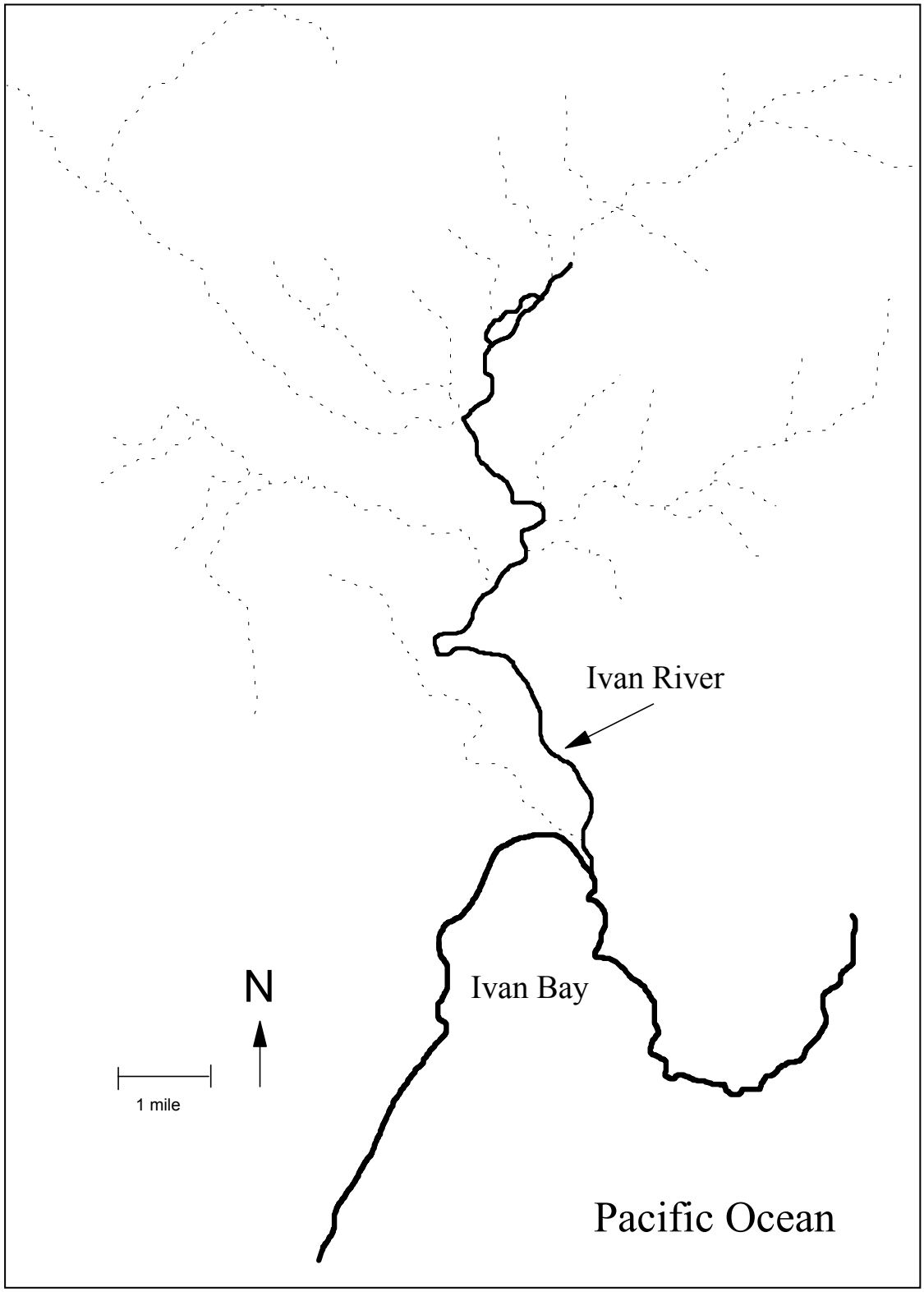

Figure 5. Ivan River survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

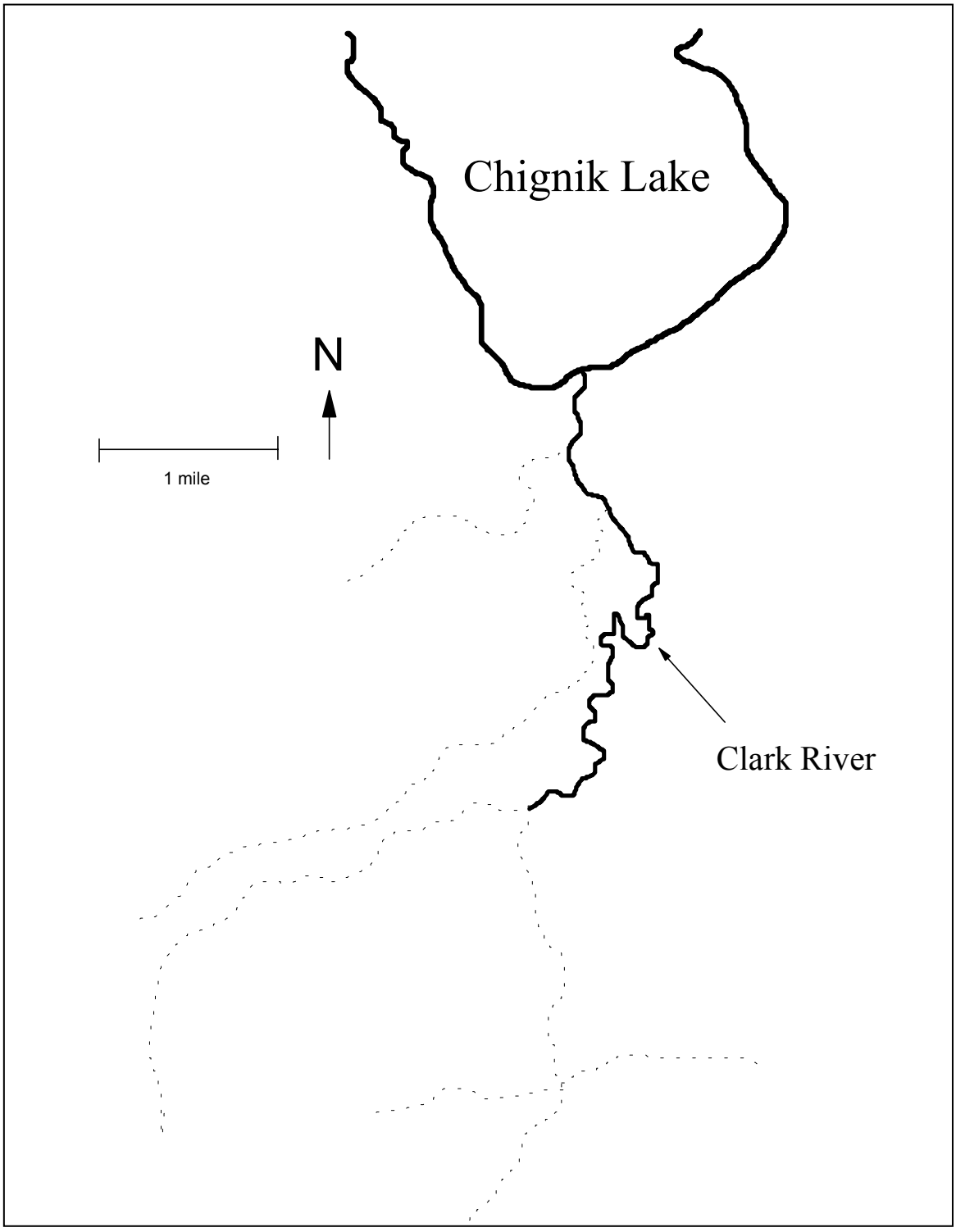

Figure 6. Clark River survey area, Alaska Peninsula National Wildlife Refuge. Streams shown with dashed lines were not surveyed.

Two fishermen were observed using hook and line gear near the mouth of Ivanof River on 6 October. Two fishermen were observed using a gill net approximately 5 miles upstream from the mouth of Ivanof River on 5 November, and a third person was observed upstream of the fishermen on an all terrain vehicle.

Discussion

Coho salmon counts were similar for streams that were surveyed in 2003 and 2004 (Table 2). In both years, fish counted in October were mostly observed in large pods and not actively spawning, and most fish counted in November were actively spawning. Except for Red Bluff Creek, numbers of coho salmon observed during the first survey in 2004 were lower than those observed during the first survey in 2003. For Ivanof River, numbers of coho salmon during the first survey in 2004 were half of those observed during the first survey of 2003. However, we do not know if this represents a significant decrease in coho salmon escapement for 2004, or whether these numbers represent differences in run timing or survey timing between years. Surveys in future years will be scheduled for late September and mid October, which will increase our knowledge of peak migration timing for coho salmon in each system. Fewer sockeye salmon were counted in Clark River during the second survey in 2004 compared to the second survey in 2003 (Table 2).

The second survey in both years occurred too late to observe coho salmon peak spawning activity. Also, coho salmon counted during the November survey may not be representative of entire spawning populations in each system. Coho salmon often spawn in smaller tributary streams (Sandercock 1991), and most of these were not included in our surveys due to logistical constraints. In future years, we will focus our surveys to obtain counts of coho salmon during peak staging and migration times in mainstem rivers before coho salmon access the smaller tributary streams for spawning.

Weather and water conditions affected the aerial surveys in 2004. As in 2003 (Anderson 2004a), poor water clarity in Wasco's Creek prevented us from counting fish. Turbid water from storms or glacial runoff was not the issue during either survey attempt. The sandy substrate and tannic-stained water combined to limit visibility in the stream, and observation conditions were not adequate for accurate counts. Wasco's Creek is not suitable for aerial surveys, and will not be surveyed in 2005. Glacial water from the Long Beach River near Perryville had captured both main branches of the Three Star River, and also the lower portions of Artemie's Creek in 2004. Almost all glacial runoff from Mount Veniaminof was flowing into the Long Beach River in 2004, which allowed us to survey part of the mainstem Kametolook River during the second survey period. Glacial water from the unnamed river to the east of Red Bluff Creek was overflowing into the lower reaches of East Fork Red Bluff Creek, creating marginal conditions during both surveys.

The second survey in 2004 occurred later than was planned due to pilot availability and weather conditions. Attempts were made starting on 26 October to complete the second survey, but pilot availability and a suitable weather window did not allow for the completion of the survey until early November. Beginning in 2005, the first survey will be scheduled for late September and the second survey will be scheduled for mid October.

Table 2. Comparison of coho salmon counts for streams surveyed in 2003 and 2004, except Clark River counts are for sockeye salmon. 2003 count data are from Anderson (2004a).

	2003		2004	
Stream	10 - 11 Oct.	21 - 22 Nov.	5 - 6 Oct.	6 - 7 Nov.
Ivanof River	2,600	314	1,300	330
Unnamed River, Humpback Bay	1,120	14	1,040	46
Red Bluff Creek	5,000	330[a]	7,600	836
Ivan River	2,150	217	1,840	290
Clark River	6,100[b]	9,700[b]	5,890[b]	3,240[b]

[a] Mainstem Red Bluff Creek was not surveyed due to poor water clarity. Survey numbers represent count in the East Fork.
[b] Sockeye salmon.

The October survey should provide a reasonable index of coho salmon abundance for the surveyed reaches, although it is possible that coho salmon could have entered the systems, spawned, and died between survey periods. For example, local residents in Perryville reported observing a few hundred fish near Spring Creek in late October, and captured 30 pairs to use in their side-stream incubation project. By the time we completed our second survey, these fish were not observed in Spring Creek or the Kametolook River. Perrin and Irvine (1990) report an average survey life for coho salmon of 11.4 days, which was compiled from 22 separate estimates throughout the Pacific Northwest and Alaska. Hetrick and Nemeth (2003) determined an average stream life for coho salmon of 13.7 days for coho salmon in a small stream on the Alaska Peninsula during October and November. Both estimates suggest that coho salmon may have entered, spawned, and died within study systems without having been observed during our surveys. Survey life for Pacific salmon can vary among and within streams and years (Perrin and Irvine 1990; Bue et al. 1998), so effects of the survey interval in 2004 are unknown.

Although not a total spawning escapement estimate, index counts can provide valuable information to area managers. The major flaw of an index count is that it provides a single number with no measure of precision, i.e., it does not include sampling variation. The fundamental assumption is that index counts represent a constant proportion of the true counts across time. In general, the usefulness of any population survey depends upon obtaining unbiased, or nearly unbiased, and precise parameter estimates in a cost-efficient, logistically feasible manner (Thompson et al. 1998). Due to the inclement weather and "flashy" nature of the streams in this region during late fall, getting a more precise estimate of coho salmon escapement is neither logistically feasible nor cost effective.

We recommend continuing the aerial surveys for additional years. The data collected to date with this project have provided managers with information for coho salmon spawning populations in streams near Perryville, including minimum numbers and migration timing. Monitoring in future years will further refine survey timing to coincide with peak staging and

migration timing of coho salmon, allowing us to compare counts from year to year with more confidence.

Acknowledgements

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